REMARKS

Claims 1, 3-20, and 22-24 are pending in this application. Claims 1 and 16-20 have been amended. New Claim 24 has been added. Claim 21 has been canceled. Support for the new claims is found in the specification and claims as filed.

Claim Rejections – 35 U.S.C. § 103(a)

Claims 1 and 3-23 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Fiato (U.S. Pat. No. 4,618,597) in view of Ozin (U.S. Pat. No. 4,552,855). It is well settled that the Examiner "bears the initial burden of presenting a *prima facie* case of unpatentability..." *In re Sullivan*, 498 F.3d 1345 (Fed. Cir. 2007). Until the Examiner has established a *prima facie* case of obviousness, the Applicant need not present arguments or evidence of non-obviousness. To establish a *prima facie* case of obviousness, the Examiner must establish at least three elements. First, the prior art reference (or references when combined) must teach or suggest all of the claim limitations: "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 165 U.S.P.Q. 494, 496 (CCPA 1970); *see also M.P.E.P. § 2143.03*. Second, there must be a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091 (Fed. Cir. 1986); *see also M.P.E.P. § 2143.02.* And finally, the Examiner must articulate some reason to modify or combine the cited references that renders the claim obvious. Merely establishing that the claimed elements can be found in the prior art is not sufficient to establish a *prima facie* case of obviousness:

> As is clear from cases such as *Adams,* a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007) (emphasis added).

Instead, the Court has made clear that the Examiner must establish a reason one of skill in the art would have combined the elements of the prior art, and that such reason must be more than a conclusory statement that it would have been obvious.

> Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, this analysis should be made explicit. *See In re Kahn,* 441 F.3d 977, 988 (C.A.Fed.2006) ("[R]ejections on obviousness grounds cannot

> be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness"). *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-1741 (2007).

Affidavits or declarations, when timely presented, containing evidence of criticality or unexpected results, commercial success, long-felt but unsolved needs, failure of others, skepticism of experts, etc., must be considered by the examiner in determining the issue of obviousness of claims for patentability under 35 U.S.C. 103. See M.P.E.P §716.01(a). A prima facie case of obviousness can also be rebutted if the applicant can show that the art in any material respect taught away from the claimed invention. *In re Haruna*, 249 F.3d 1327 (Fed. Cir. 2001).

Applicants respectfully submit that the pending claims as amended are not obvious under 35 U.S.C. § 103(a) for the reasons detailed below.

The pending claims are directed to self-supported catalyst particles consisting essentially of α-Fe_2O_3, which, despite heating, and against all expectations, have not undergone a phase change from α-Fe_2O_3 to another form (e.g. a spinel form, as in Fiato and Ozin), such that the catalyst has improved properties when used in a Fischer-Tropsch reaction. Independent Claim 1 recites "[s]elf-supported precipitated α-Fe_2O_3-based Fischer-Tropsch catalyst particles for a Fischer-Tropsch slurry-bed process, which particles are produced according to a method comprising the step of: heat treating precipitated α-Fe_2O_3-based particles at a temperature of from 360°C to 500°C, whereby self-supported precipitated catalyst particles consisting essentially of α-Fe_2O_3 are obtained." Independent Claim 17 recites "Fischer-Tropsch catalyst particles, wherein the catalyst particles have an average primary particle size of from 2 nm to 4 nm, are self-supported, and consist essentially of α-Fe_2O_3."

Fiato teaches the use of iron manganese spinels (corresponding to chemical formula $(Fe_{1-x}Mn_x)_3O_4$; e.g., a mixture of alpha iron oxide and gamma magnesium oxide) as catalysts in Fischer-Tropsch synthesis. As discussed in the attached Declaration of Dr. Jan Petrus Karel Reynhardt, manganese in the spinel affects both the chemical and physical properties of the catalyst, which in turn affect both the activity and selectivity of the catalyst, thus resulting in a completely different catalyst from that recited in the pending claims. The compositions and characteristics of a pure iron catalyst (e.g., α-Fe_2O_3) and an iron-manganese spinel as in Fiato are markedly different, and thus result in catalysts with vastly different product selectivities and activities. Spinels (e.g., iron-manganese spinel) usually perform completely differently from pure phases (e.g., iron oxide) in that the reduction as well as activation procedures differ due to the presence of a second metal in a different oxidation state than the iron. The product selectivity differences are also evident in that when manganese is used in the catalyst, this leads lead to shorter chain olefins under low temperature Fischer-Tropsch (LTFT) conditions. The iron-manganese spinel catalyst is therefore designed and prepared for a completely different purpose as well as operating window than is the iron oxide catalyst, which is specifically tailored to produce long chain waxy products. The preparation process described in Fiato includes a heat treatment step (see col. 7, l. 13). The temperatures used in this step are between 100-350°C, and the preferred temperature range is 150-200°C. The heat treatment therefore takes place at lower temperatures than claimed in the present application, which is preferably carried out at 60°C or higher, more preferably 380°C. The calcination at 360°C+ of applicant's catalyst is performed to allow water to be removed from the surface of the catalyst, thereby promoting cross binding between the iron oxide particles increasing the strength of the catalytic particles. The preferred temperature is above 360°C for this cross binding process to occur in a reasonable amount of time.

In the Office Action, it is noted that Fiato discloses alpha Fe_2O_3, and Example 2 and col. 2, ll. 42-45 are specifically cited. Regarding Example 2, Fe_2O_3 is mentioned at line 29; however, the particular form of Fe_2O_3 is not specified. Example 2 uses the Fe_2O_3 as a starting material in the formation of an iron manganese spinel catalyst; the Fe_2O_3 itself is not the catalyst. Regarding the passage at col. 2, lines 42-45, it is noted that the catalyst of Kolbel consists of a precipitated mixture of gamma Mn_2O_3 and alpha Fe_2O_3 inserted in the manganese oxide lattice. Accordingly, the alpha Fe_2O_3 is not self-supported, and the presence of gamma Mn_2O_3 results in a catalyst having different properties than a catalyst consisting essentially of (see, e.g., Declaration of Dr. Jan Petrus Karel Reynhardt regarding spinels performing completely differently from pure phases in that the reduction as well as activation procedures differ due to the presence of a second metal in a different oxidation state than the iron).

Ozin is cited in the Office Action as disclosing alpha iron oxide. It is asserted in the Office Action that the passage at col. 7, lines 26-32 discloses alpha iron oxide for use in Fischer-

Tropsch catalyst particles – this is incorrect. The passage teaches iron in zero-valent (i.e., metallic, or non-oxidized) form for use as a catalyst, not use of an oxidized form: "No further activation treatment of the material is necessary before it is employed as a catalyst, apart from possible removal of residual solvent, its metal component already being present as a catalytically active substantially zero-valent form" (see col. 7, lines 21-26). Applicants also note that all iron in Ozin, regardless of the form, is associated with the zeolite, and thus is in supported form. Use of iron oxide catalysts for Fischer-Tropsch processes is not taught, much less catalysts in self-supported form or catalysts consisting essentially of alpha iron oxide. Applicant notes that the catalyst particles recited in each of the pending claims consist essentially of α-Fe_2O_3. Iron in α-Fe_2O_3 is in a +3 valent state (hematite, an oxidized form; $2Fe^{+3} + 3O^{-2} = Fe_2O_3$; see, e.g., Wikipedia entry for Iron(III) oxide). In contrast, iron in metallic form is in a zero valent (Fe^0; non-oxidized) state. Applicants are claiming α-Fe_2O_3, wherein all iron is necessarily in a +3 valent state – iron in other valent states (e.g., +2 or 0) cannot be α-Fe_2O_3. Being in "non zero valent" form or being "not zero valent" is an inherent characteristic of α-Fe_2O_3. Ozin only teaches the zero valent form of iron as a catalyst, not iron in an oxidized state, e.g., α-Fe_2O_3.

In summary, Fiato teaches only iron manganese spinel catalyst forms; such forms exhibit different properties from pure iron oxide forms as recited in the pending claims (see attached Declaration of Dr. Jan Petrus Karel Reynhardt). There is nothing in Fiato that would suggest to one of skill in the art that a catalyst consisting of alpha iron oxide should be used for Fischer-Tropsch synthesis, as Fiato only uses such alpha iron oxide as a starting material in the formation of iron manganese spinels. Even in the Kolbel reference and the Van Dijk reference cited in the Background of the Invention section of Fiato concern alpha Fe_2O_3 in association with manganese oxide. One of skill in the art would conclude that manganese was a necessary component of the catalyst of Fiato, necessary for Fischer Tropsch activity. Ozin includes no teaching overcoming the deficiencies of Fiato. At best, combining the teachings of Fiato with Ozin would result in a catalyst containing both manganese and iron.

The catalysts as presently claimed consist essentially of alpha Fe_2O_3. See MPEP § 2111.03 Transitional Phrases: "The transitional phrase "consisting essentially of" limits the scope of a claim to the specified materials or steps "and those that do not materially affect the basic and novel characteristic(s)" of the claimed invention. *In re Herz*, 537 F.2d 549, 551-52, 190 USPQ

461, 463 (CCPA 1976) (emphasis in original)." As discussed in the Declaration of Dr. Jan Petrus Karel Reynhardt, the presence of manganese would impact the Fischer-Tropsch activity of the catalyst.

Accordingly, Applicants respectfully request withdrawal of the rejection.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any remaining concerns that might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the telephone number below.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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